

# Survey of Plant-parasitic Nematodes in Missouri Cotton Fields<sup>1</sup>

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**Abstract:** During September 1990, 30 cotton fields in each of three Missouri counties were surveyed for plant-parasitic nematodes. Soil samples for nematode analysis consisted of a composite of 20 cores collected in a zig-zag pattern within a 1-ha block in each field. Cores were taken from within weed-free cotton rows. Nine genera of plant-parasitic nematodes were found (*Rotylenchulus*, *Helicotylenchus*, *Hoplolaimus*, *Meloidogyne*, *Paratylenchus*, *Pratylenchus*, *Tylenchorhynchus*, *Heterodera*, and *Trichodorus*), and five species were identified: *Meloidogyne incognita*, *Rotylenchulus reniformis*, *Hoplolaimus galeatus*, *Pratylenchus vulnus*, and *P. scribneri*. This is the first report of *R. reniformis*, *H. galeatus*, *P. vulnus*, and *P. scribneri* in Missouri cotton fields and the first report of *R. reniformis* and *P. vulnus* in Missouri. The known cotton pathogens *M. incognita*, *R. reniformis*, and *H. galeatus* were found in 30%, 3%, and 2% of the fields sampled, respectively. The correlation between sand content of the soil sample and the number of vermiform *M. incognita* in the sample was not significant, with  $r^2 = 0.13$ . Select fields where *H. galeatus* and *R. reniformis* were found in 1990 were sampled more intensely in 1991. The 1-ha block sampled in 1990 was sampled in 1991, along with three other 1-ha blocks uniformly distributed within the field. In addition, a 1-ha block was sampled in each of eight nearby fields, within 2 km of the first field. The nine plant-parasitic nematode genera identified in the 1990 survey were observed again in 1991. Within-field distribution of *M. incognita*, *R. reniformis*, and *H. galeatus* was not uniform. When *M. incognita*, *R. reniformis*, or *H. galeatus* were present in a field, the same species was found in 38%, 25%, or 50% of nearby fields, respectively.

**Key words:** cotton, *Gossypium hirsutum*, *Meloidogyne incognita*, Missouri, nematode, *Rotylenchulus reniformis*, *Hoplolaimus galeatus*, survey.

Farmers in Missouri harvest approximately 100,000 ha of cotton (*Gossypium hirsutum* L.) annually (5), all from the southeast portion of the state in an area known as the "Bootheel." The majority (98%) is grown in New Madrid, Pemiscot, and Dunklin Counties.

Several known weeds, insects, and diseases limit production of cotton in Missouri. The presence and geographic distribution of these pests are known, and education programs have been implemented to help farmers combat them. Unfortunately, information on the presence and geographic distribution of plant-parasitic nematodes in Missouri cotton fields was unknown. Nematodes reduce cotton production in the United States by 2% annually, and may reduce production in some areas by 50% or more (6).

The objective of this project was to survey cotton fields in Missouri for geographic distribution of plant-parasitic nematodes.

## MATERIALS AND METHODS

During September 1990, 30 cotton fields in each of New Madrid, Pemiscot, and Dunklin counties were surveyed for nematodes. The map of each county was divided into 30 equal-sized areas, then a soil sample was collected from one arbitrarily selected cotton field close to the center of each area. Each sample was a composite of 20 soil cores (2.5-cm-d × 20 cm deep) collected in a zig-zag pattern from within a 1-ha block of each field. Cores were taken from within weed-free cotton rows. Each composite sample was sealed in a plastic bag and stored on ice until it could be transferred to a 4 C refrigerator. The sample was mixed and one 100-cm<sup>3</sup> subsample of soil was analyzed for texture, and another 100-cm<sup>3</sup> subsample for nematodes. Nematodes were extracted by semiautomatic elutriator and centrifugation (1) and the plant-parasitic nematodes were identified to genus. Adult females were hand-

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picked and processed to glycerin (8) for species identification. For identification of *Meloidogyne* spp., seedlings of *Lycopersicon esculentum* Mill. cv. Rutgers were transplanted into infested soil and allowed to grow for 60 days, at which times species were identified based on the perineal patterns exhibited by 10 females (3).

Fields 210 and 225 where *Hoplolaimus galeatus* (Cobb) Thorne was found in 1990, and fields 303 and 317 where *Rotylenchulus reniformis* Linford and Oliveira was found in 1990, were more intensely sampled in 1991. The 1-ha block sampled in 1990 was sampled in 1991, along with three other 1-ha blocks uniformly distributed within the field. In addition, a soil sample was collected from a 1-ha block in each of eight neighboring fields, all within 2 km of the first field. Samples were collected, stored, and analyzed for nematodes as in 1990.

### RESULTS

Nine genera of plant-parasitic nematodes were found in Missouri cotton fields in 1990, and three species of known cotton pathogens were identified: *M. incognita* (Kofoid & White) Chitwood, *R. reniformis*, and *H. galeatus* (Table 1). *Meloidogyne incognita*, *R. reniformis*, and *H. galeatus*, were found in 30%, 3%, and 2% of the fields sampled, respectively. *Pratylenchus* spp. were observed in 30% of the samples. *Pratylenchus vulnus* Allen & Jensen was identified from 10% and *P. scribneri* Steiner from the remaining samples. Sufficient

data were not collected on *Pratylenchus* to conclude that these were the only species present. The nine plant-parasitic nematode genera identified in the 1990 survey were observed again in 1991. This is the first report of *R. reniformis*, *H. galeatus*, *P. vulnus*, and *P. scribneri* in Missouri cotton fields and the first report of *R. reniformis* and *P. vulnus* in Missouri.

Approximately 25% of the samples contained a single plant-parasitic nematode genus, and 75% were polyspecific. Of the polyspecific samples, approximately 50% contained two genera, 30% contained three genera, and 20% contained four or more genera.

Geographic distribution of nematode genera varied among counties (Table 1). For example, *M. incognita* was present in 20%, 27%, and 43% of the samples from New Madrid, Pemiscot, and Dunklin counties, respectively. *Hoplolaimus galeatus* was found in 7% of the samples from Pemiscot county, but it was not found in New Madrid or Dunklin counties.

Based on 1991 samples, within-field distribution of *M. incognita*, *R. reniformis*, and *H. galeatus* was not uniform (Table 2). For example, *R. reniformis* was found in two of four samples in field 210, and *Hoplolaimus galeatus* was found in one of four samples from field 225.

Detection of certain nematodes in the same 1-ha area of a field during 1990 and 1991 varied. Vermiform *M. incognita*, *R. reniformis*, and *H. galeatus* were detected in

TABLE 1. Plant-parasitic nematodes found in Missouri cotton fields in September, 1990.

Nematode	Number of fields/county†			Range in nematode density/ 100-cm <sup>3</sup> soil
	New Madrid Co.	Pemiscot Co.	Dunklin Co.	
<i>Rotylenchulus reniformis</i>	0	1	2	4-9
<i>Helicotylenchus</i> spp.	14	17	9	4-81
<i>Hoplolaimus galeatus</i>	0	2	0	5-9
<i>Meloidogyne incognita</i>	6	8	13	4-565
<i>Paratylenchus</i> spp.	8	2	5	4-68
<i>Pratylenchus</i> spp.	6	6	15	4-107
<i>Tylenchorhynchus</i> spp.	3	4	12	4-47
<i>Heterodera</i> spp.	7	7	7	5-86
<i>Trichodorus</i> spp.	4	6	5	5-26
Total fields sampled	30	30	30	

† A 1-ha block was sampled in each of 30 fields/county.

TABLE 2. Within-field distribution of three species of plant-parasitic nematodes in Missouri cotton fields in September 1990 and 1991.

Field†	Portion of field sampled‡	Nematodes/100 cm <sup>3</sup> soil					
		<i>M. incognita</i>		<i>R. reniformis</i>		<i>H. galeatus</i>	
		1990	1991	1990	1991	1990	1991
210	a	0	0	0	26	5	0
210	b		0		0		0
210	c		0		13		9
210	d		0		0		0
225	a	5	0	0	0	9	60
225	b		0		0		0
225	c		0		0		0
225	d		0		0		0
303	a	0	0	9	9	0	0
303	b		17		13		0
303	c		0		13		0
303	d		0		0		0
317	a	34	21	9	0	0	0
317	b		39		0		0
317	c		4		0		0
317	d		9		0		0

† Fields 210 and 225 were in Pemiscot county and 303 and 317 were in Dunklin county.

‡ Four 1-ha areas in each field were sampled in September, 1991. Only one area (portion a) was sampled in both years.

some fields in 1990 but could not be detected in the same area of the field in 1991 (Table 2). *Rotylenchulus reniformis* was not detected in field 210 in 1990 but was present in 1991.

Distribution of certain nematodes within neighboring fields was not uniform. When *M. incognita*, *R. reniformis*, or *H. galeatus* were present in a field, the same species was found in 38%, 25%, and 50% of nearby fields, respectively.

The number of juvenile *M. incognita*/100-cm<sup>3</sup> of soil ranged from 4–565. The correlation between sand content and number of *M. incognita*/100-cm<sup>3</sup> of soil was not significant, with  $r^2 = 0.13$ .

#### DISCUSSION

Cotton growers and consultants in Missouri should be aware that the known cotton pathogens *R. reniformis*, *H. galeatus*, and *M. incognita* (6) were found in Missouri cotton fields during a survey in 1990. This is the first report of *R. reniformis* in Missouri cotton fields. It has been reported in all Gulf Coast states, Georgia, North and South Carolina, and Arkansas (4), but never as far north as Missouri. It

was also found in three of 311 fields sampled in Southwest Tennessee (Melvin Newman, pers. comm.). Fields with *R. reniformis* in Missouri and Tennessee were slightly above and below 36°N, respectively. Those areas are approximately 60 miles north of the previously reported northern limit, 35°N, for *R. reniformis* (4). Apparently *R. reniformis* can survive in the upper mid-south region of the United States, but the threat it poses to cotton and other plants in Missouri is unknown, since the numbers recovered were low in all samples compared to the cotton damage thresholds for this nematode in Mississippi (2). *Meloidogyne incognita* was previously reported in Missouri (7) and is a known pest of cotton there. Fortunately, the numbers of *M. incognita* were low in all field sites sampled but one. Nematodes should be considered when diagnosing cotton problems in Missouri.

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